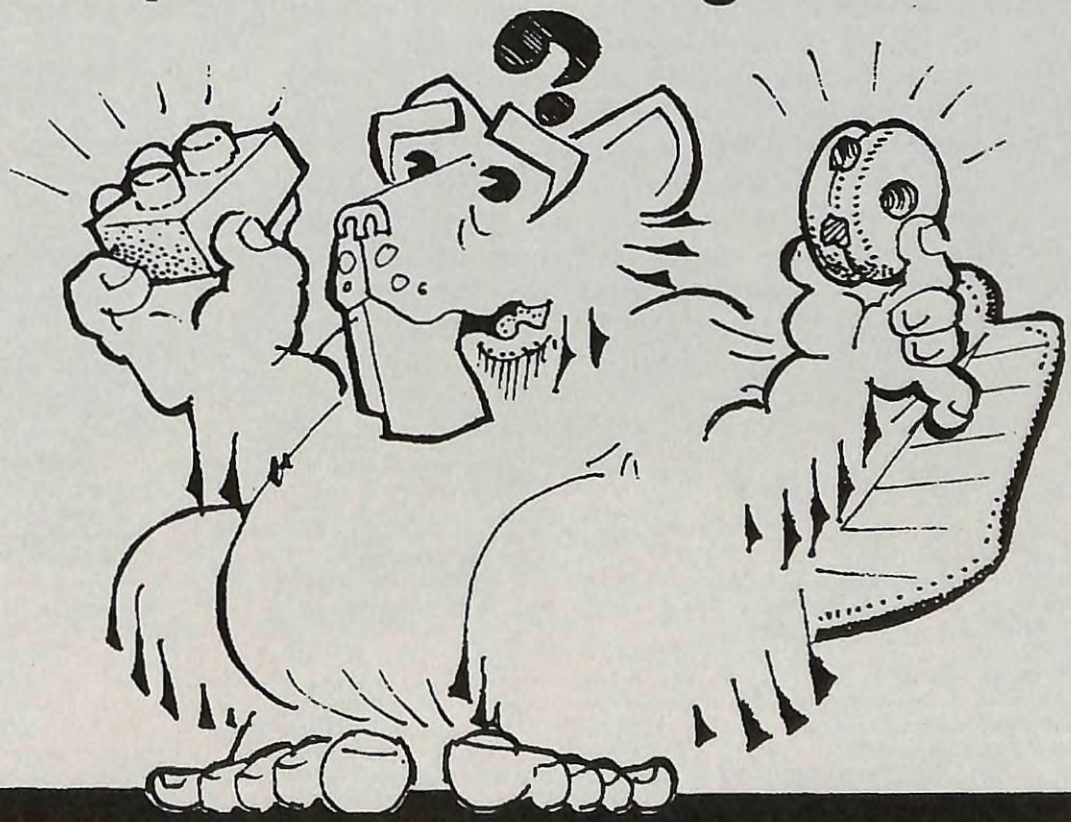
No. 112 September 2003

solplan review

the independent journal of energy conservation, building science & construction practice

Inside

Incompatible Building Materials



From the Editor

There is still much denial that climate change is actually taking place. That human activity is a major factor in the production of greenhouse gases is still being denied by many, especially those exploiting fossil fuels.

As the summer of 2003 fades into memory, we should reflect on the events of this past season. Those events confirm the predictions that climatologists have made. Their models, imperfect though they may be, indicated the nature of the changes that would occur.

In Canada and Europe, many homes and heritage structures were consumed by fires. At times it looked like the infernos would consume entire communities. In Eastern Canada, the summer was soggy, only to end with a heat wave in Newfoundland that even closed schools. In the far north, ice shelves that have been in place for thousands of years are now breaking up. Northern birdwatchers are observing species that have never been seen that far north. Record-breaking heat waves had a direct effect on thousands of people who died as a result. And these heat waves came soon after record hot summers in each of the last few years.

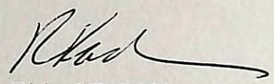
The tragedies and miseries inflicted by climate change are adding to the GDP. Since our society is obsessed with economic indicators, the human cost will not be given due credit, but the economic activity generated as a result of the devastation will be noted positively.

We can do something to slow and, in time, reverse the worst aspects of climate change, but it will take a major shift in attitudes. The challenge is that the magnitude of the problem is so great that it overwhelms individuals. It is a case of: What can I as an individual do? Yet it is individual actions multiplied many times that add up to a much greater impact. If you remove one truckload of soil from your property, it will not do much to change the property's contours, but if you remove one hundred or one thousand truckloads it will be noticeable very quickly.

Making changes to deal with climate change will require an attitude shift on a societal level. It will not be easy, but it can be done. After all, our material goods obsessed society has become that way only in a couple of generations.

As builders and designers, we can do a lot to help deal with the big issues we are facing. As a starting point, we must be more energy and resource efficient in our activities. This means being more careful with the tools and vehicles we use, to avoid those gas-guzzlers. We must aggressively pursue higher levels of energy efficiency in our projects. It may be unpopular to say, but it may mean being supportive of more stringent energy codes and standards. It means being more creative in our building developments, to reduce the urban sprawl.

Change will not come easy, but must be initiated – and immediately. We no longer have the luxury to procrastinate.



Richard Kadulski,
Editor

solplan review
the independent journal of energy conservation, building science & construction practice

Editor-Publisher: Richard Kadulski
Illustrations: Terry Lyster
Contributors: J F Burrows, Conrad Baumgartner, Dara Bowser, Paul Vaillancourt, Rod Nadeau, Rob Dumont, Jim Stewart
ISSN: 0828-6574
Date of Issue: October 2003
SOLPLAN REVIEW is published 6 times per year by:
the drawing-room graphic services ltd.
Box 86627, North Vancouver, BC V7L 4L2
Tel: 604-689-1841 Fax: 604-689-1841
e-mail: solplan@direct.ca
Street address:
#204 - 1037 West Broadway
Vancouver, BC V6H 1E3

Canadian Publications Mail Product Sales Agreement No. 40013363
Postage paid in Vancouver, BC.

SUBSCRIPTIONS: In Canada 1 year $50.29 (incl GST) (NB, NS, NF $54.05 includes HST); 2 years $90.95 (incl GST) (NB, NS, NF $97.75 includes HST). USA and other foreign payable in US $ 1 year $54.00, 2 years $98.00.

CHANGE OF ADDRESS: include a mailing label or copy all information off label for faster, accurate processing.
CONTRIBUTIONS: Unsolicited contributions and manuscripts welcome. Include self-addressed pre-stamped mailer if return requested. Publisher not responsible for loss or damage of same.
While every effort is made to provide accurate and complete information, we do not warrant or guarantee the accuracy and completeness of such information.
ADVERTISING POLICY: Publisher's discretion in the acceptance of any advertisement. No endorsement is stated or implied by the publisher.
PRINTED IN CANADA
GST Registration: R105208805
SOLPLAN is a registered trademark of the Drawing-Room Graphic Services Ltd.

Incompatible Building Materials

In the past 30 years, construction has become much more complex. Buildings no longer just provide shelter from the elements. When buildings are designed today, it also important to consider energy efficiency, use of materials that reduce their impact on the environment, waste reduction and more stringent code requirements for fire, durability, indoor air quality, sound transmission and moisture and mould control.

The increased complexity of details has been accompanied by a vast increase in the number of materials used. The dramatic increase in the number of materials used can result in a greater incidence of failure due to material incompatibility because of the wider range of possible combinations of materials, finishes, furnishings and accessories. Innovation always has an impact. In some cases, the full ramifications of using new products are not completely understood until it is too late. Occasionally, one material can have a detrimental effect on an adjacent material resulting in premature material degradation. Builders, renovators and building designers need to be aware of this incompatibility issue and consider it when selecting materials.

Code officials also need to be sensitive to this issue, since new materials may require different combinations of assemblies.

The use of incompatible materials can result in deterioration of one or both materials, reduced service life, discolouration or poor adhesion between materials. The technical literature that accompanies various construction products may identify incompatibility issues, but such instructions may not always be noted by the trades on the jobsite. Where several trades are involved, compatibility issues may be overlooked at the interface of such components as windows, roofing, foundations, deck coatings and other elements where a number of materials and trades meet.

It is likely that many problems are not reported or recorded, so there is little shared learning between building professionals, and problematic material combinations may be repeated from job to job for quite some time.

Because there is no central registry for recording and sharing incompatibility problems, the Canada Mortgage and Housing Corporation and the Canadian Home Builders' Association initiated a research project to help the home building industry to become and remain aware of material incompatibility situations. The project documented building material incompatibilities so lessons learned in the field can be shared. It is hoped that increased awareness of building material incompatibilities will reduce construction defects to the benefit of builders, designers and homeowners.

It is intended that the information identified by this study will be augmented, corrected, abridged and updated to include additional information as deemed appropriate.

The Incompatible Building Materials report is a first attempt at identifying and recording cases of incompatibility. The report contains 35 examples of incompatibility cases that building professionals and construction industry practitioners should be aware of, in addition to the myriad of building performance issues that result from climatic and building environment factors. For each example documented there are likely several others that have not been reported. In the longer term, it is hoped that the information could be posted on the Internet to make it easier to add other examples of material incompatibility as they arise.

A review of the examples reported shows that some are old problems that still happen as a result of lack of awareness or failure to foresee the consequences, such as dissimilar metals. Other examples of incompatibility are caused by a new generation of materials, such as sealants, and may occur because of the wide range of chemical formulations and the wide range of materials they are used with.

The report shows that sealants and metals are two groups of materials that had several incompatibility reports. In the case of sealants, there are many products to suit a wide range of applications. There is no simple, standardized product labelling system to help avoid improper selections.

Other cases result from jobsite-imposed conditions or deadlines. For example, the rush to apply paint in unheated conditions as winter approaches often ignores the temperature ranges recommended for a product. While ignoring the

product limits may get the project completed in time, it also brings a fairly high likelihood of recalls at a later date, often at higher cost than doing the work according to instructions in the first place.

Causes of material incompatibility

Some of the incompatibility cases reported are well understood scientifically. It has long been known that the combination of two different metals will result in the accelerated corrosion of one. The science of metallurgy is well advanced, but the challenge is to inform builders so problems can be avoided. It is not a case of one metal being better than the other – simply that precautions are necessary in cases where the use of two different metals cannot be avoided. These types of incompatibilities can usually be identified and substantiated by literature research.

Other incompatibility cases involve new products or applications of products that were not expected during product development and testing. Often, these incompatibilities are only discovered on the jobsite. In these cases, an incompatibility may not have gathered enough prominence for its effects to be replicated and documented scientifically.

Physical incompatibilities can happen when materials react differently to temperature. For example, if torch-on type roof membranes are installed over self-adhered or spray-applied membranes, the application heat may cause self-adhered or spray-applied membranes to melt.

Chemical incompatibilities happen when adjacent materials react chemically. For example, the chemical composition of asphalt roof membranes may cause certain rubber membranes to decompose.

The accompanying table summarizes some of the material incompatibility problems identified, and possible solutions. ☼

Incompatible Building Materials: A report documenting premature failure in residential construction resulting from material incompatibility
Prepared by J.F. Burrows Consulting
for Canada Mortgage and Housing Corporation

Material/ Incompatibility	Problem	Solution
concrete/non-ferrous metals (aluminum, copper, Lead, Zinc)	Embeded non-ferrous metals in concrete or mortar can lead to either failure of the metal or damage to the concrete.	**Aluminum**: Coat the aluminum with bituminous paint, impregnated paper or felt, plastic, or an alkali-resistant coating will prevent or sharply reduce the corrosion. **Copper**: Chloride admixtures should not be used in concrete if contact with copper is expected. **Lead**: concrete-embedded portion should be coated with epoxy, varnish, asphalt or pitch. **Zinc**: Embedded galvanized iron should be protected with epoxy, varnish, asphalt or pitch.
Copper flashing/Metal fasteners	Copper flashing fastened with non-copper fasteners is subject to galvanic action and corrosion.	Use copper nails or screws for fastening copper flashings.
Housewrap/ Surfactants	Properties of spunbonded polyolefins can change due to surfactants, which can originate from certain types of wood species or additives mixed with the stucco to improve workability during installation.	For wood species with high tannin content install the cladding over rainscreen strapping so that the cladding is not in direct contact with the housewrap. For stucco, a system that separates the stucco from the housewrap should always be used.
Vinyl siding/Rigid insulation	Vinyl siding applied directly over expanded or extruded polystyrene rigid insulation has a high coefficient of expansion. In the spring and fall, movement of the vinyl siding as a result of fluctuating temperatures causes squeaking noises that are audible through walls.	A layer of housewrap or building paper should be installed between the vinyl siding and the EPS or XPS insulation to isolate the materials
Bitumens/Polystyrene foam insulation	Bitumens and some adhesives can cause polystyrene insulation to disintegrate. they can also be destructive to single-ply roofing membranes.	With new and replacement roofing projects, ensure that polystyrene insulation is covered with an approved panel to keep it separate from bitumens and other solvent based materials.
Metal Fasteners/Cedar, redwood and treated wood products	Unprotected fasteners made of metals susceptible to corrosion should not be used with wood products treated with copper-based preservative(ACQ, CCA)	In general, hot-dipped galvanized, coated fastenersrecommended by the preservative manufacturer or stainless steel fasteners
EPDM membranes/ Bituminous-based air barrier memnbranes and flashings	EPDM roofing membranes are prone to becoming brittle and cracking where they contact bituminous-based membranes and flashings (most likely to occur at roof edges and parapet walls).	Galvanized-metal transition flashing should be installed between EPDM membranes and any bituminous-based membranes and flashings.
Sealants/Rigid insulation	Solvent-based sealants (or adhesives) cause the degradation of polyethylene or polystyrene foam insulation. Sealants and adhesives are not interchangeable. Polystyrene is incompatible with aromatic hydrocarbons and other petroleum-based compounds. Silicones are typically compatible with polystyrene.	There are many types of sealants and there are several types of sealants and adhesives that are not solvent-based. Use latex (acrylic) butyl, silicone sealants or adhesives with polystyrene rigid insulation.
Silicone sealants, acid-cure/Other materials	Acid-cure sealants contain acetic acid and cure by emitting the acid (a vinegar-like smeell). They adhere well to most surfaces but the acetic acid is aggressive to many materials including epoxies,concrete, mortar, many types of fasteners and steel.	There are many types and formulations of sealantsHave a basic understanding of the types of sealants, their strengths and weaknesses, and choose accordingly.
Silicone sealant/Mirrors	Silicone-based sealants and adhesives cause the break down the backing of mirrors if they are affixed to walls with acetic-cure silicone adhesives.	Use specially-formulated mirror mastics. Neutral curing silicones have a good history of success in this application.
Polyurethane sealant/Asphaltic materials	Asphalt roofing materials contain solvents that can damage (poly)urethane sealants. Contact of asphalt materials with (poly)urethane sealants will result in discolouration, sealant delamination, softening and deterioration of one or both materials.	Use sealants and adhesives approved by the membrane manufacturer.
Paint/Wood knots	Painting over knots can result in discoloration of the paint because of the resins in wood knots.	Knots should be primed with a sealer before painting. Orange shellac is a good material for priming knots or sap streaks in wood but it loses its drying ability as it ages so test to ensure the shellac will dry. Most varnishes today contain polyurethane, which is not compatible with shellac. When varnishing over sap or knots, apply the varnish directly to the wood and do not prime with shellac.

Avoiding Scalding And Legionellosis In Tap Water

Scalding and legionellosis associated with hot tap water in homes is a major concern. It is estimated that in Quebec alone, tap water scalds result in 33 hospitalizations and three deaths per year. Water contamination from legionella is a cause of legionellosis, but there is not enough data available to determine how many legionellosis cases are caused by this contamination. However, it is considered to be at least as important as tap water scalds in terms of public health.

The risk of tap water scalds is greater among children under five, people over 60 and people with a physical or mental deficiency. The risk of legionellosis is greater among those with immune deficiencies.

Quebec public health authorities (Institut national de santé publique du Québec) believe that preventing tap water scalds and legionellosis is important. In both cases there are well-known, effective prevention measures. The Institute has prepared a paper, available in both official languages, with recommendations on how to minimize scalding and legionellosis.

The best strategy to decrease the risk of tap water scalds in private homes is to lower tap water temperature to 49°C (120°F) or less.

To reduce the risk of legionellosis, one needs to limit exposure to legionella via tap water, which is best done by heat treatment of the water. Although it may not be necessary to set water heater thermostats as high as 60°C (140°F) to prevent legionella proliferation inside the tank, there is no conclusive information on the appropriate temperature level. However, the World Health Organization recommends storing water at 60°C or higher.

To prevent both legionellosis and scalding, the Quebec Institute recommends setting gas or oil water heater thermostats to 60°C and equipping water heaters with effective anti-scald devices.

Electric water heaters

In Quebec, more than 90% of homes use electric water heaters. It is estimated that about 30% of electric water heaters are contaminated by legionella, even when the thermostat is set at 60°C. Electric water heaters are more likely to be contaminated than gas or oil water heaters because of their design. Water temperature in the lower part of the tank cannot be raised high enough to kill legionella.

Quebec would like to see electric water heater manufacturers find technological solutions to prevent legionella from multiplying in these water heaters. In the meantime, they recommend setting the thermostat to 60°C on electric water heaters. To reduce the risk of scalding, they recommend installing an effective anti-scald device on the water heater outlet to lower the water temperature to 49°C.

Gas or oil water heaters

The risk of legionella contamination in gas water heaters is lower than in electric water heaters. The risk for contamination is low if the thermostat is set at 49°C, and probably non-existent when set at 60°C.

It seems that the water temperature in gas or oil water heaters increases by several degrees above the thermostat setting due to repeated demands for hot water. Due to this thermal fluctuation, the risk of scalding remains even if the thermostat is set at 49°C, necessitating an anti-scald device. They suggest that anti-scald devices should be installed on new water heaters upon manufacture.

If anti-scald devices are incorporated as part of the water heater itself, they suggest that, within a few years, this would protect most people relying on hot water from this type of water heater due to the equipment replacement cycle. ☼

Concerns have been expressed about appliances such as dishwashers and clothes washers that require water temperatures hotter than 49°C. Some units have their own internal heaters.

It is standard practice for European equipment to include an internal heater. This is one reason why it is possible to hook up washers only to cold water and still wash in water temperatures as hot as 93°C (200°F).

Studies have shown that reducing dust mite allergens requires washing clothes and bedding at temperatures of 55°C (131°F) or hotter.

An unabridged version of this document is available on the Institut national de santé publique du Québec (National Institute of Public Health) Web site: *http://www.inspq.qc.ca*

Prevention of Scalding and Legionellosis Associated with Hot Tap Water in Private Homes by: Michel Lavoie, M.D., M. Sc., FRCPC; Benoît Lévesque, M.D., M. Sc., FRCPC; Diane Sergerie, M. Sc.; In collaboration with Pierre Maurice, M.D., M.B.A., FRCPC; Marc Dionne, M.D., M.P.H., CSPQ

Preventing Legionnaires' Disease

Legionellosis, or legionnaires' disease, is a form of pneumonia caused by bacteria that are naturally occurring organisms in water. Outbreaks of legionnaires' disease are often blamed on germs from poorly maintained air-conditioning systems in large buildings.

Recent studies reveal that the bacteria often grow in the slimy residue lining residential hot water pipes, and home water may be responsible for about 20 percent of cases. The evidence suggests that the residential water system is an underestimated source of legionnaires' disease.

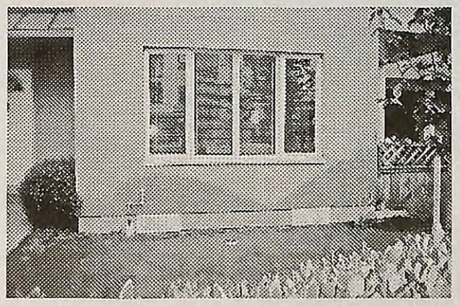
The latest findings were presented at a recent conference of the American Society for Microbiology. Estimates have been made that between two and five percent of cases of pneumonia requiring hospitalization in the United States each year are caused by legionella pneumophilia bacteria. The condition is often misdiagnosed because finding legionella bacteria requires special tests.

The bacteria flourish at temperatures between 32° and 40°C (90° and 105°F). People catch the germs by inhaling water droplets, which can happen while showering, washing or even drinking, especially if people have swallowing difficulties and accidentally inhale some water. Fortunately, most people exposed to the bacteria never get sick. Those who are susceptible may include the elderly as well as people with diabetes or diseases that weaken immune defences.

To kill off legionella bacteria, temporarily turning up the temperature to above 60°C (140°F) and running the hot water outlets for a half-hour can flush out the water system. Since the bacteria quickly return, this should be done every few months, especially if people prone to the infection are using the water. Another strategy to avoid contact is to let the shower run on hot for a few minutes before using it, as this will flush out some of the bacteria that may have built up in the pipes. ☼

Safe Kids Canada has requested a change to the National Building Code to limit the maximum temperature of hot water to each fixture in a home to 49°C (120°F). This would require domestic water heating devices to be factory-set not to exceed this temperature. This request could also be met by using a master mixing valve at the water heater, having it built into the unit, or using a temperature-activated mixing valve at each fixture.

All of these options are currently available, but may be used only at someone's discretion. In the US, all water heaters are already delivered with the lower setting as the norm.



Letter to the Editor

Re: Pressure Washers: Is There Trouble Ahead? (Solplan Review No. 111, July 2003)

As usual, Solplan Review is full of timely articles. I look forward to each issue.

Your article on pressure washers in the July 2003 issue brings up another similar issue. Water is often added daily to walls during the summer months by lawn sprinklers. We see this happening extensively and have informed all the property management companies we work for to have sprinklers adjusted to avoid wetting walls such as in the photo attached.

The sprinklers wet the wall at the bottom where the wall is most susceptible to driving rain, runoff from the upper elements of the wall and direct rays of the sun. Keeping a wall wet all year round can prevent it from drying after a wet winter. The hot summer sun increases the risk for reverse vapour drive, especially since the sprinklers can be on in full sun or early in the morning, wetting the wall ready for the hot mid-day summer sun.

Bart Blainey
Pro Deck Ltd.
Victoria, BC

Healthy Indoors Partnership

New Initiative Aims to Achieve Healthy Indoor Environments in Canada

We spend the majority of our lives indoors. Despite the progress that is being made, there is convincing evidence that many indoor surroundings are damaging the health of the people working and living in them. Several leading US authorities, the Canada Mortgage and Housing Corporation (CMHC) and others have consistently identified indoor pollution as one of the most serious risks to human health. In the US, indoor pollution is estimated to cause thousands of cancer deaths and hundreds of thousands of respiratory health problems each year.

The Healthy Indoors Partnership (HIP) has been launched to be a national Canadian not-for-profit organization focussed exclusively on indoor environment issues. It joins together a wide range of government, non-government and industry stakeholders. The HIP aims to raise awareness of the opportunities and benefits that improving indoor environments can bring to the health, well-being and productivity of Canadians, as well as to build a movement toward creating a powerful and permanent response to indoor environment issues in Canada.

For more information on the Healthy Indoor Partnership, visit www.healthyindoors.com

Indoor pollution has grown because there are no clear structures or strategies for dealing with indoor environment issues. In contrast to outdoor environment issues, government policy toward the indoor environment has been limited and fragmented. Research has identified an urgent need for improved communication and co-ordination among those interested in healthy indoor environments. The Healthy Indoors Partnership intends to provide just that. It has three main areas of focus: the consolidation and integration of research; the promotion of guidelines and best practices; and the fostering and marketing of outreach programs.

The HIP offers a free quarterly newsletter to help Canadians stay up-to-date on indoor environment issues, and operates the only national clearinghouse of such information in Canada.

The Healthy Indoors Partnership is supported by a unique partnership of government, private sector and NGOs. Partners include Health Canada, the National Research Council, Canada Mortgage and Housing Corporation, Natural Resources Canada, Pollution Probe, the Atlantic Health Promotion Research Centre, National Air Technologies, CIMATEC, the Canadian Carpet Institute, Broan Nutone Canada, and Venmar Ventilation Inc. ☼

Ten Years of Environmental Building News on CD

Interest in sustainable, energy-efficient, high-performance building is growing dramatically and with it the need for objective, pertinent information. Environmental Building News is an excellent source for green building information. For more than ten years this newsletter has been providing practical and in-depth analysis of environmental issues in the building sector.

Environmental Building News has released an updated version of the EBN Archives CD-ROM, a compendium of more than ten years of their newsletter, from the first issue in mid-1992 through the end of 2002.

The EBN Archives are fully searchable and provide instant access to every article, diagram, and photo as they appeared in print. They are a valuable green building reference tool that provides a wealth of information on a wide range of topics related to green building – from land-use planning and energy efficiency to recycled-content materials and indoor air quality. The thoroughly researched, probing articles dig deep into issues and provide accurate, objective information.

The CD is packed with practical, "how-to" information, including checklists with tips and suggestions, case studies that show how designers and builders are successfully incorporating green building ideas into their work, and reviews of green building products – with comments from users on how these perform in the field.

EBN Archives CD costs $199 to first-time buyers; $79 for an upgrade. Information: www.BuildingGreen.com or call BuildingGreen at 1-800-861-0954, ext 191.

The Whistler Healthy EnviroHome

We used to live in simple homes built from locally available natural materials. They had lots of healthy fresh air and a fireplace or pot-bellied stove to provide heat and comfort. Unfortunately, that fresh air was because of the drafts and air leaks in the construction and the fireplace which was inconsistent and needed a lot of work to keep going.

With the help of modern technology and manufactured materials we eliminated those drafts and leaks. Natural materials were replaced with new "improved" manufactured products; we sealed our homes against drafts and forgot about the health of our indoor environment. Many products we put into our homes today are not good for us, so that we are no longer building homes that are healthy to live in. We have many problems that are described indirectly when we talk about sick building syndrome, offgasing, or leaky condos, etc.

We want to have clean, draft free, comfortable homes that are also durable and maintenance free, and we can have them. We can have draft free, durable homes that are also energy efficient, healthy and with superior indoor air quality. All we have to do is pay attention to the choices we make about the hundreds of components we use to build our homes. Some are healthy and durable and some are not so healthy.

Rod Nadeau of Nadeau & Associates Ltd. of Whistler gave himself a challenge. When he decided to build the Whistler Healthy EnviroHome, he wanted to show that all the resources needed to build a better, healthier, energy efficient home were readily available. He did not change his building budget or radically alter the design of the home or traditional building methods. He simply set out to make better choices.

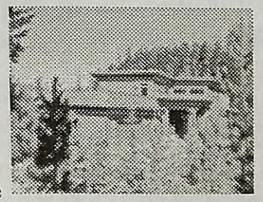
Rod wanted to introduce to the Whistler market an enhanced home with all the features of the homes he builds plus the additional features of a healthy, quiet home, with low maintenance and long-term durability.

Rod's team looked at the whole building process and asked how they could make healthy choices, reduce waste, have less impact on the environment, and build a longer lasting more durable home. They were surprised to find that, in almost all aspects of building the home, the answers were there; all they needed was to find them and put them all together. There are many suppliers committed to making good quality, durable and healthy building products. The tradesmen, material suppliers and subtrades all came up with better ways to build. Everyone involved in the project had a genuine interest in building a better home. The one thing that surprised a lot of people involved was that it did not cost more to build a better home. They just had to change the way they built and thought about building homes.

They chose to build the home as an R2000 EnviroHome since this is a well-established Canadian standard that promotes environmentally sustainable building practices. It provides a Canadian guideline for "green" building practices for residential construction.

Their design tried in subtle ways to reduce waste and make the building more efficient to build. They did not compromise on the design or quality to achieve those objectives. The natural materials selected actually enhanced the design and quality of the home.

The steeply sloped infill site had many challenges that were treated as opportunities. The grade dropped about 30 feet from the road, so the site required about 20 feet of fill, even with the lower floor being a walk-out. They reused rock from another construction project nearby, reducing the cost and trouble of having to haul it to a gravel pit for disposal. The fill quantity was augmented with recycled wine bottles. The raised grade also helped the home



Whistler EnviroHome Project goals

- Meet or exceed all the criteria for the R2000 Envirohome program.
- Have a low environmental footprint by using the least amount of resources to build the home.
- Use environmentally sustainable products and building practices.
- Have a long term, low operating cost including low energy consumption and using long lifespan products that require little or no maintenance.
- Use construction methods without the need for specialized training or specialized fields, using existing trades and skills.
- Use off-the-shelf components that are readily available from local suppliers and labour pools.
- Have easy, intuitive control over the living comfort levels.
- Create a healthy home with a high quality indoor living environment which owners can easily and intuitively control their indoor climate conditions.
- The quality of the building and all of its components must be of equal or higher quality than comparable homes.
- The home should use Canadian-made and designed products.

For information on the R-2000 Program, contact your local program office, or call 1-800-387-2000 www.R-2000.ca

gain better views of the mountains to the west. Thus the home's appearance from the road is that of a more modest two-storey home with the driveway, although a large portion of the living space is below street level, and all rooms have large mountain and forest views.

Insulated concrete forms (ICFs) were selected to build the shell. They met all the criteria to build a strong, durable, energy efficient home. The insulated concrete form walls are draft free which leads to increased overall comfort for the occupants, and they also offer good noise reduction from outside noises.

ICFs are simple and quick to use and do not require highly skilled tradesmen to install them. Once the shell was completed with the windows and doors installed, all the holes in the walls for wiring and utilities were sealed with expanding foam to complete the sealing of the home from drafts. At this stage an air leakage test was done on the home to find any air leaks that were missed while they were all still exposed and could be easily sealed. The air test came in at 1.0 air changes per hour, well below the limit set by the R-2000 Standard.

A key component of a healthy home is good clean fresh air. Ventilation needs to be sized to provide good air exchange, sized for the number of people in the home. The zoned heat recovery ventilator system provides ventilation where and when the people in the home need it.

Windows are important parts of a home. They open up the home to the view, bring in natural light, and can contribute greatly to the home's comfort level and its energy efficiency. They are also one of the easiest ways to improve a home's energy performance. Tilt-and-turn high-performance vinyl windows were selected. They are triple glazed, low E coated, argon-filled sealed glass units.

The sources of indoor air pollution were reduced by careful selection of materials. Low VOCs, paints and finishes were used throughout. Today these do not cost more than conventional finishes. Most of the dust and pollens in the home are found in the wall-to-wall carpet. By using hard surfaces such as tile and hardwood for flooring throughout, they reduced the amount of dust. ☼

Buying Whistler Envirohome Can Save Owner More Than $700,000!

What is the value of the increased investment in a home meeting the R-2000 Standard? Every builder has been asked "What's the payback of R-2000?" anytime the issue of energy efficiency is raised.

When looking at energy savings and payback, it is important to remember that any economic analysis is only as good as the underlying assumptions. Decisions on energy standards and energy savings are typically done on the basis of predictions about future energy prices. If energy prices change, these assumptions become obsolete. For example, the energy requirements in present building codes and in the Model National Energy Code were based on assumptions about energy prices that were made ten years ago. Recent changes in energy prices have made those assumptions obsolete, since energy costs in many areas have exceeded the highest price increases forecast.

Rod Nadeau reviewed the costs and benefits of his Whistler Envirohome to calculate the payback. He considered all the operating and maintenance expenses that go along with home maintenance. The elements he considered included lighting, painting of window frames, deck and siding finishes and replacement, structural maintenance, window replacement, space heating and hot water operating costs.

Less frequently considered are interior maintenance issues, such as cleaning costs and their impact on indoor air quality. Hard surfaces are longer lasting, easier to maintain and have less dust associated with them compared with carpeted floors, which require not only maintenance but also more frequent replacement. To ensure that the numbers used were reasonable, Rod had them reviewed by an accountant.

Rod's analysis indicates that the person who buys his Whistler EnviroHome could save as much as $773,998 over a 30-year period. The assumed discount rate was 4%. These savings come about as a result of decreased energy use, lower maintenance, repair, replacement and cleaning costs. The cost savings may seem optimistic, and expenses high, but this is a luxury home (sales price just under $3 million) in a world class resort community, and are representative costs for a high-end home in Whistler. ☼

Selling Energy Efficiency

... helping your customers make the right choices

by Paul Vaillancourt

As the cost of energy continues its upward trend with no relief in sight, it is becoming increasingly important that builders and heating and ventilation contractors fully understand all aspects of energy efficiency.

Companies looking to the future need to realize that to survive and prosper, there must be a shift in how they do business. They need to become energy solution providers with a broad-based knowledge of available technologies.

Understanding building technology and promoting energy efficient building practices will be a great asset to companies wanting to sell advanced energy efficient technologies. Reducing energy requirements is the single most important factor in reducing not only energy costs but also capital costs for the equipment required to service the energy requirements.

Consumers want to know about available technologies so they can make an informed decision that suits their needs. Offering a customer energy efficient options will certainly put some distance between you and your competition.

How do you sell efficiency?

An important first step is understanding energy efficiency ratings. Your customers will appreciate your expertise when you can explain what the energy efficiency ratings mean to them in dollars and cents. Listed below are some of the efficiency ratings most commonly used.

EER — Energy Efficiency Ratio: A ratio calculated by dividing the cooling capacity in Btu/h by the power input in watts at any given set of rating conditions, expressed in Btu/h per watt. This is a steady state condition.

SEER — Seasonal Energy Efficiency Ratio: A measure of seasonal cooling efficiency under a range of weather conditions assumed to be typical of a location, as well as of performance losses due to cycling under partial load operation. It represents the total cooling of a central air conditioner or heat pump (in Btu) during the normal cooling season as compared to the total electric energy input (in watt-hours) consumed during the same period.

HSPF — Heating Seasonal Performance Factor: The total heating output of a heat pump during its normal annual usage period for heating divided by the total electric power input during the same period. Expressed in Btu/watt.

While the industry seems to be promoting higher SEER-rated air conditioners, the enthusiasm seems to have carried over to air source heat pumps as well. When looking at heat pumps, you need to look at HSPF ratings too, since heating, not cooling, is the dominant load in all regions of Canada.

It is interesting to note that some lower SEER units have better HSPF ratings than higher SEER units. While some experts may suggest that higher SEER-rated units are more efficient in both cooling and heating over a wider range of temperatures, this is not always the case. For example, the moderate climate on the West Coast is an exception.

Since heat pumps typically have an auxiliary source of energy (such as an electric resistance heat element) to meet the heating requirements beyond the balance point of a home. The second stage of the appliance should be controlled so it will not be energized unless the balance point has been exceeded. This could easily be achieved by incorporating an outdoor stat or sensor to complete the circuit between first and second stages.

One of the primary reasons for higher than expected operational costs of a heat pump is because many heat pump thermostats will turn on the second stage with an adjustment of less than two degrees F. The homeowner, unaware of the implications of raising the temperature just a couple of degrees, will suffer the consequences when the hydro bill arrives.

COP — Coefficient of Performance: A ratio calculated by dividing the total heating capacity (Btu/h) by the total electrical input (watts) x 3.412

AFUE — Annual Fuel Utilization Efficiency: The AFUE is an average of how much heat a furnace delivers for each unit of energy. It is the measure of seasonal or annual efficiency of the furnace or boiler. It takes into account the cyclic on/off operation and associated energy losses of the heating unit as it responds to changes in the load, which in turn is affected by changes in the weather and occupant controls.

AFUE ratings do not include the electrical consumption of an appliance. This could also be a significant cost in operating the appliance, especially when continuous fan operation is desired. Therefore, fan type should be a major consideration when selecting an appliance.

Paul Vaillancourt
Ecco Heating Products Ltd.
Burnaby, BC
This item appeared first in the Fall 2003 issue of Heat BC, *the newsletter of the Heating, Ventilating and Cooling Industry Association of BC.*
www.hvci-bc.com

How do you install efficiently?

Mechanical contractors can do a better job of selling efficiency over their competition even when the equipment the competition uses has equal or better ratings. There is a lot more to an efficient heating and cooling system than equipment ratings.

Equipment ratings are calculated in a laboratory setting, which means they do not take into account the air distribution system; there is no consideration of installation practices, nor of any house features that could impact performance. In reality, the chances of actually getting 12 SEER out of a 12 SEER unit in a home may be less than 2 in 10. The biggest factor that will determine how close to the ratings the unit will perform is the system design and installation. A new system that is the wrong size, connected to a poorly designed and leaky duct system, and then improperly charged with refrigerant, will not come close to performing the way the manufacturer intended. ☼

The basic requirements for selling energy efficient heating systems

1. A proper room-by-room heat loss calculation is a must for every job.
2. Equipment must be sized to meet the calculated loads.
3. The distribution system must be designed and installed properly.
4. A good control strategy is important.

Give the homeowner an energy cost analysis. It will help close the deal and allow you to sell a better system while improving your bottom line.

Available technologies you may wish to consider:

- Condensing gas furnaces
- Two-stage heating and cooling equipment
- Variable speed ECM or ICM motors
- Variable capacity condensing boilers
- On demand high efficiency water heaters
- Domestic water heat pumps
- Air source heat pumps
- Ground source heat pumps
- Swimming pool heat pumps
- Smart control systems

Technical Research Committee News

Canadian Home Builders' Association

Copies of the report *Water Penetration Resistance of Windows* can be obtained from CMHC or the HPO, which has the report in the Research & Education area of their Web site at *www.hpo.bc.ca*

Water Penetration Resistance of Windows

Water Penetration Resistance of Windows is the report, available on CD, that was prepared by a team of consultants headed by RDH Building Engineering Limited of Vancouver. This two-part report, sponsored by Canada Mortgage and Housing Corporation, the Homeowner Protection Office (of BC) and the BC Housing Management Commission, is a comprehensive analysis of windows and window installation with an extensive graphics package.

Part one is a *Study of Manufacturing, Building Design, Installation and Maintenance Factors*. The object of this study was to determine the primary leakage paths and causes of water penetration associated with windows and the window to wall interfaces. The study does not address other performance issues associated with windows such as condensation control, air tightness and structural adequacy. It includes an appendix that is a glossary of terminology used in the window industry.

The graphics package that accompanies the study is impressive. It includes full a PowerPoint slide presentation illustrating report findings as well as a window installation sequence for wood frame and non-combustible construction assemblies for a variety of exterior siding materials (stucco, wood siding, and brick veneer).

A companion project is titled *Codes, Standards, Testing and Certification*. This study identifies ways that building codes, standards, testing protocols and certification processes can be improved to better mandate effective water penetration control associated with windows and the window to wall interfaces.

A CMHC Best Practice Guide for windows document is to be developed. The research information will also be incorporated into a training course on windows and window installation.

Mould

Mould has been a concern to builders for some time, especially since it has gained a high public profile in recent years. CMHC has been asked to assist with information dissemination for builders and renovators.

CMHC will be consolidating information that's already available and will put it into a form that's useful to builders and renovators. They are about to complete a revision to an existing document called Clean-Up Procedures for Mould in Houses. This 60-page document looks at defining problems, evaluating problems and fixing problems aimed mainly at the professional. The content is being brought into step with the Committee on Environment and Occupational Health (a federal/provincial committee), as well as the revised New York Protocol and a few others. A bibliography will be included in this document.

CMHC would also like to convert existing material into a one-day training session on mould for builders and renovators. A pilot of this session is planned for October in Ottawa.

Builders and renovators have also expressed a need for ways of finding answers to questions. These will be compiled into a "Frequently Asked Questions" that will provide useful answers.

The Healthy Indoors Partnership is an incorporated non-governmental organization. Its purpose is to bring together a breadth of interest on indoor environment issues and to connect people with sources of information. CHBA has indicated a need for appropriate consultations on mould concerns.

The IRC will be doing a field study to identify the building science factors that affect houses with and without mould.

Guide to Objective-based Codes

With the change in the code to an objective-based format, a lot of work will have to be done to communicate the changes, so that implementation can be smooth. The Codes Centre is preparing training material, but at this time there are no plans for a document that would bridge the training planned for building officials and be a source document for all other parties on how to take advantage of the alternative compliance route.

CHBA has identified a need for a guidebook to the new code format, and will be pressing for the development of such a guide.

Canadian Electrical Code

There are two issues of concern for builders before the committee reviewing the electrical code. One deals with an expanded use of arc fault circuit interrupters and the other with the expanded use of ground fault circuit interrupters. Both are being studied by subcommittees. CHBA has recruited an electrical consultant to help with the review of the material and to provide advice. CHBA will keep a watch on new requirements as they are drafted, so that the impact on builders is properly understood by all parties.

The Technical Research Committee (TRC) is the industry's forum for the exchange of information on research and development in the housing sector.

Canadian Home Builders' Association, Suite 500, 150 Laurier Ave. West, Ottawa, Ont. K1P 5J4
Tel: (613) 230-3060
Fax: (613) 232-8214
e-mail: chba@chba.ca
www.chba.ca

Solplan Review Back issues

A limited number of back issues are available, at a special price of $5.50 each (plus 7% GST).
Bundle special: a random selection of back issues (minimum 22 copies) are available for only $60.00 (plus 7% GST)

Solplan Review
Box 86627
North Vancouver, BC V7L 4L2
e-mail: solplan@direct.ca

NRC·CNRC

Making Engineered Wood Joists Easier to Use

By Bruno Di Lenardo

Engineered wood joists and structural composite lumber have greatly changed the way wood-frame buildings are built because they provide more strength and longer spans, among other advances. In an effort to make such products easier for designers and builders to use, the Canadian Construction Materials Centre (CCMC), working with the Canadian Wood Council, manufacturers and others, has assembled test protocols and criteria, and validated manufacturers' span tables for engineered wood joists, thus eliminating the need for further project-specific engineering for small buildings. As part of this work, vibration criteria were also established.

Engineered wood joists and related products

In the late 1960s, the first steps were made to convert codes and standards from Working Stress Design (WSD) to Limit States Design (LSD) in order to better address structural safety and serviceability issues such as deflection, vibration and cracking. LSD was introduced into Part 4 of the National Building Code (NBC) in 1975 and will likely become mandatory for all materials in the next edition, expected in 2005. The CSA standard "Engineering Design in Wood" requires I-joists to be designed using LSD since 1998. As part of its evaluation process, CCMC has guided engineered wood joist manufacturers in the conversion to LSD, making it easier for engineers to incorporate this type of product into their designs. Products evaluated by CCMC include prefabricated I-joists and open-web joists – both metal-web joists and wood-web glued joists – as well as structural wood adhesives and rimboards. Each type of joist has gone through an initial "qualification" process involving testing to establish suitable design values.

Bruno Di Lenardo is an evaluation officer with the Canadian Construction Materials Centre of the National Research Council's Institute for Research in Construction. He can be reached at (613) 993-7769, or e-mail *bruno.di_lenardo@nrc-cnrc.gc.ca*. This article is based largely on information published in recent issues of the Institute's newsletter, *Construction Innovation*. CCMC Evaluation Reports can be found in the CCMC Registry of Product Evaluations, available on the Institute's Web site at:
http://irc.nrc-cnrc.gc.ca/ccmc/regprodeval_e.shtml

I-joists

CCMC bases its evaluation of prefabricated I-joists on ASTM D5055, which outlines the qualification process required to determine characteristic values for flexural strength and creep, shear, flange end-joints, stiffness, end-bearing and web openings. These values are then converted to Limit States Design format. The next step is to confirm that the engineered floor joist design meets the CSA O86-01 loading and deflection requirements as well as the NBC vibration requirement. Once this has been ascertained, manufacturers can develop proprietary span tables for end users.

Open-web joists

Proprietary open-web floor joists are typically designed using known structural analysis models. Manufacturers then develop span charts according to the NBC, taking into account anticipated loads and serviceability criteria. CCMC confirms these span tables by specifying full-scale tests, thus verifying that the manufacturer's span charts are adequate to support the design loads and account for long-term creep. In addition, manufacturers have to conduct specific tests to confirm the variability of the failure modes of these joists. This focused test program for open-web joists is necessary to assist in the conversion process to Limit States Design (from Working Stress Design) until such time as that process for this type of joist has been completed and published.

Engineered wood joist vibration criteria

Vibration criteria to achieve acceptable performance (i.e., to avoid floors that are uncomfortably bouncy) were added to the NBC in 1990. However, expanding the criteria to apply to new structural products – in this case, engineered wood joists – required the development of a design procedure funded by a consortium of engineered wood product manufacturers. The vibration criteria for acceptable performance are represented by an allowable deflection under concentrated load for a given span (not to be confused with the NBC criteria for deflection under uniform load).

Once these criteria were developed, manufacturers were able to design vibration-controlled spans of up to 10 m, taking into account the composite action of the sub-floor, bridging and strapping, ceiling membrane and concrete topping that provide equivalence to NBC lumber span charts. However, at an industry meeting held in May 2000, representatives of the engineered wood joist industry agreed to move toward a more comprehensive frequency-based approach to predicting floor vibration in light-frame floors. CCMC will oversee the implementation of this new 'dynamic' approach once adopted.

Field experience has shown that the current vibration criteria may overestimate the maximum acceptable span for concrete-topped floors and floors with bridging and/or blocking when installed at the limit of the permitted span. Manufacturers are now aware of this shortcoming and should be consulted when these types of floors are installed at or near the maximum span.

Structural wood adhesives

Currently, structural wood adhesives must conform to CSA standards O112.6 and O112.7, which apply to phenol formaldehyde (PF) and phenol-resorcinol formaldehyde (PRF) adhesives. Dark-coloured PRFs have a long-standing record with respect to strength and durability. But as the popularity of engineered wood products has increased, there has been increased consumer interest in newly developed, pale adhesives that provide a cleaner look. While there is a CCMC protocol for evaluating and assessing the durability of these new adhesives (see CCMC 12846-R and 12905-R for examples of such evaluations), at present, there is no CSA standard that addresses these issues. A new performance-based CSA adhesive standard is currently being developed, and once it has been published, it will be adopted by CCMC.

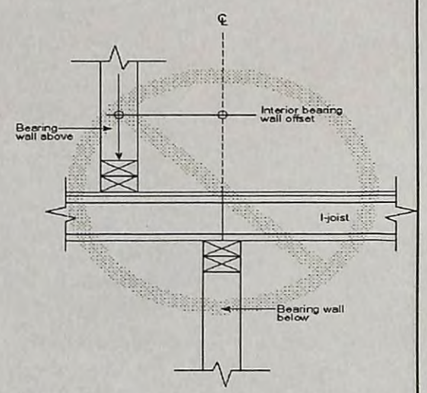
Rimboards

Rimboards, which take the place of the headers used in traditional wood flooring, complete the floor design and ensure that the floor transfers loads successfully from the shear walls above the floor to the shear walls or foundation below, which is particularly important in high wind or seismic zones. CCMC evaluates proprietary engineered wood rimboards for capacity under compressive loads, for lateral loads and bending when the rimboards act as lintels for basement windows, and for durability. CCMC's lateral load test includes a specific configuration that verifies lateral capacity according to the NBC nailing schedule. For an example of a rimboard evaluation, see CCMC 12974-R, and more reports to come. ☼

Important Notice to Industry

Interior bearing wall offsets with I-joist floors - standard detail solution on its way

The practice of offsetting interior bearing walls when using prefabricated I-joist floors was recently brought to the attention of CCMC. Although offsetting may be common practice with lumber joist floors, as permitted by the National Building Code (NBC), it must be recognized that this is ***not*** the case with prefabricated I-joist floors (see figure).



Example of unacceptable detail: I-joist floor with upper bearing wall offset from lower bearing wall.

Manufacturers' installation details for I-joists do not currently address the issue of offsetting interior bearing walls. As a result, this requires an engineer to verify the shear capacity of the joist and specify the web reinforcement necessary to ensure proper load transfer from the bearing wall above to the one below.

CCMC has brought this issue to the Wood I-Joist Manufacturer's Association (WIJMA) and they have responded by forming a task group to develop a standardized detail for offsetting bearing walls.

Until a detail is published by each manufacturer to deal with the situation, builders and building officials alike must be aware that this type of installation is beyond the scope of what has been evaluated and published, and requires an engineer's review on a case-by-case basis.

Energy Answers

Rob Dumont

What are the "Seven Sisters" of a good indoor environment?

I once heard a talk by a Norwegian heating and ventilating engineer who spoke very eloquently of the "Seven Sisters." Here are his "Seven Sisters" in no particular order:

1. Temperature
2. Light Levels
3. Sound and Vibration
4. Flora and Fauna
5. Electromagnetic Fields
6. Indoor Air Quality
7. Psychological and Social Environment

People who design buildings should be aware of each of the Seven Sisters, and try to design to get each of the Sisters right. Take heating systems, for example. A bad heating system will obviously affect temperature, but can also affect sound and vibration (noisy duct systems, motor vibrations) and indoor air quality (chimney backdrafting, cracked heat exchangers, carbon monoxide producing burners). Moisture from air-conditioning coils can cause bacteria and mould to grow, affecting the Flora and Fauna.

As I mulled over the Seven Sisters list, I recalled various incidents in my life where one of the Seven Sisters was acting up or otherwise not right.

1. Temperature.

On the hot side, I once worked at Kitimat (as did our esteemed Solplan Review Editor) where aluminum oxide powder is converted to aluminum metal using an electrolytic refining process. This is a hot process, both in terms of temperature (the melting point of aluminum is about 550°C) and electromagnetic fields (electric currents of 100,000 amperes are typically used in the cells.) Because of the risk of scalds from hot metal, we wore wool sweaters and wool pants and leather gloves, none of which are great for hot environments. One of my co-workers there walked with a pronounced limp. At one time he had stepped through the crust of an electrolytic cell and his leather boot touched the molten aluminum. There was a saying at the Kitimat plant that "No one retires from this plant."

On the cold side, there is little to compare with walking across a Saskatoon bridge when the air temperature is about -30°C and the wind is howling. It's enough to make you forget Kitimat.

The ASHRAE people suggest that the comfort zone indoors for temperature in summer is between about 23°C and 27°C for typical summer clothing and primarily sedentary activity. In the winter, the comfort zone is between about 20°C and 24°C for typical winter clothing and primarily sedentary activity. In general, the lower the relative humidity, the higher the allowable temperature. Some studies have been done to show that if people have some control over their environment such as an openable window, they will accept a broader temperature range.

2. Light levels

Once while working in Nairobi, Kenya, which is located at about a mile above sea level, I was coaching a team in a multi-game outdoor basketball tournament held during the day. Being brought up in Vancouver's lower rainland, I was not accustomed to such bright clear days! I got a dose of sun-stroke, both from the high outdoor light levels and the temperature at the equator (the atmosphere is thinner at high altitudes, and Nairobi is at a 1700 metre elevation; thus the light levels and solar radiation levels are also higher.) Only mad dogs and Canadians go out in the midday sun. Outdoor light levels on a bright sunny day are approximately 100,000 lux (lumens/square meter) [9300 foot-candles].

For office work these days in Canada, light levels in the range of about 300 to 700 lux are typically seen. As more people are using computers, acceptable light levels are falling.

In Sri Lanka, where electricity is very expensive relative to incomes, a level of 150 lux is the current standard for offices. On my desk the Lutron light meter reads about 250 lux.

3. Sound and Vibration

I once attended the rock movie "Tommy" that was likely run by what must have been a deaf projectionist. I spent the better part of the show with my fingers covering my ears.

The human ear, like the human eye, is not a linear receptor. We can hear sounds as low as a very faint 10 decibels to levels higher than 120 decibels. Apparently at some higher sound level your eardrums will burst and you will likely bleed through your ears. In the sound frequency range from 500 Hz to 5,000 Hz, the tolerable sound pressure variation is about 1012 or 1,000,000,000,000 to 1.

4. Flora and Fauna

Plants and Animals. The Winnipeg Zoo has, or had, an indoor planetarium with lots of flora and fauna in it. In the wild, the feces from the bird life can be dissipated back to nature without too much of a problem. In an enclosed environment, the feces smell can be overwhelming. Sorry, Winnipeg. Most animal enclosures suffer the same fate.

It is of interest that many people do like both living flora and fauna in their homes, to which the proliferation of tropical plants and pets can attest. Most people, however, draw the line at ants, silverfish, cockroaches, mice, rats, etc. People with allergies generally do not do well in indoor environments with lots of flora and fauna.

Dust mites in homes are strongly associated with allergic reactions.

5. Electromagnetic Fields

My story goes back to Kitimat and the summer of '64, where the electrolytic cells carried direct currents of 100,000 amperes. We often worked adjacent to the aluminum bus bars that carried these currents. Because of the high electromagnetic fields, our shoes could not have any iron in them, and we were told not to wear watches.

Apparently, even the small currents that exist in electric blankets can cause some damage. Newer blankets always have two wires side by side with the currents in opposite directions. The AC electric currents from the two adjacent wires cancel out the electromagnetic fields. (And yes, I did use an old electric blanket with individual wires generating electromagnetic fields for several years!)

We've heard quite a bit about electromagnetic pollution lately. It is known that certain electrical workers in high voltage electricity are more prone to cancer than the average population. For office workers, the electromagnetic radiation off the computer can be a concern.

6. Indoor Air Quality

There are many factors that affect indoor air quality – relative humidity, volatile organic compounds (usually from emissions from building materials and furnishings), dusts, vapours, pollen, viruses, etc.

Tobacco smoke is a particularly nasty indoor air contaminant, annually killing about 40,000 Canadians and about five million people globally from the direct effects of smoking, and affecting the health of many people through second-hand smoke. Over 2000 chemicals have been identified in tobacco smoke, and at least 50 of the components are known to have adverse health effects. Anyone who complains about indoor air quality and continues to smoke is a hypocrite.

Here's what the Canadian Exposure Guidelines say about tobacco smoke: "It is recommended that any exposure to tobacco smoke in indoor environments be avoided... Symptoms reported by non-smokers exposed to such "sidestream" smoke include eye, nose and throat irritation, headache, nausea, dizziness and loss of appetite. Furthermore, the lingering odour and reduced visibility from tobacco smoke are aesthetically unpleasant to many people... it is widely believed that there is no level of exposure to carcinogenic substances below which a risk does not occur." My story here is that my father, a physician no less, used to enjoy cigars. I didn't, and still don't.

For relative humidity, the Canadian guideline for summer conditions is 30% to 80%; for winter conditions, the range is 30% to 55% unless constrained by condensation. A much smaller range, however, of 40% to 50% is suggested as a humidity level that reduces the incidence of upper respiratory infections and minimizes adverse effects on people suffering from asthma or allergies. Too high a humidity will often result in condensation and mould problems in a house.

The "Exposure Guidelines for Residential Indoor Air Quality" from Health Canada provides guidelines on many other air contaminants.

For volatile organic compounds, typical levels that we have measured in Canadian homes have averaged about 0.5 milligrams per cubic metre.

However, we measured one home that was being polluted by leaking gasoline from an adjacent service station. The level measured was over 100 milligrams per cubic metre. When we entered the house, the odour was so overpowering that you lost your sense of smell. A Danish researcher suggests that when total volatile organic compound levels are above about 3 milligrams per cubic metre, discomfort will result. Above 25 milligrams per cubic metre, the level is regarded as toxic. The European Community has prepared a target guideline of 0.3 milligrams per cubic metre, where no individual volatile organic compound should exceed 10% of the total volatile organic compound concentration.

7. Psychological and Social Environment

This is certainly not my area of expertise, but without a decent psychological and social environment, life can rhyme with strife.

It is one of the characteristics of human beings that, generally speaking, we can tolerate only a relatively narrow band of environmental parameters. If the temperature, light levels, sound levels, flora, fauna, electromagnetic fields, indoor air quality, etc. are not just right within relatively narrow bands, we complain. Take temperature, for instance. Temperatures can vary from a low of –273°C to hotter than 5700°C, the surface temperature of the sun. Yet we are comfortable indoors only when the temperature is between about 20°C and 27°C.

If I interpret the "Seven Sisters" properly, most of them are "goldilocks" parameters. In other words, the parameters of temperature, light, sound, vibrations, and flora and fauna must neither be too strong nor too weak.

In times past, most people could be satisfied if the temperature and the light level in a space were controlled. Now most people will insist that the Seven Sisters are all under control. ☼

Solutions for the Construction Industry

New and Improved National Research Council Web Site

http://irc.nrc-cnrc.gc.ca

The National Research Council's Institute for Research in Construction (IRC) is a prime source of information for construction practitioners in Canada. The IRC's popular Web site receives more than 120,000 "hits" each month and most of these visitors are accessing IRC publications.

"The site is a key part of our technology transfer and communication efforts," says Mike Culhane, IRC's Head of Library and Internet Services. The site contains more than 2,000 publications, many geared towards the practitioner, such as architects, engineers, and builders. Among the most popular publications are the practice-oriented *Construction Technology Updates*. The Updates are concise distillations of IRC research results and reviews of building science principles.

Another popular series is the *Canadian Building Digests*, which represent a history of building science in Canada. They were written between 1960 and 1990. By putting them on the Web, they remain accessible to users. As well, reports of innovative products evaluated by IRC's national evaluation service (CCMC) can be found in the *Registry of Product Evaluations*, which are also posted on the site.

New publications are added on a weekly basis and the Upcoming Events section is updated regularly. Anyone can sign up to receive the list of new publications by e-mail or subscribe to the electronic version of the newsletter *Construction Innovation*.

The Web site includes a searchable Index, which allows users to quickly find information on the IRC's 5,000+ Web pages, if they know what they're after.

The site also contains comprehensive information on IRC's research activities, most of which are carried out with industry partners. Another key part of the site deals with building codes. The IRC provides national leadership to the codes community in Canada and readers can follow key developments by accessing the IRC site. As Canada's largest construction research organization, the IRC also acts as a gateway for Canadians to access global construction technology information. The IRC site provides access to search the Web sites of members of the CIB (International Council for Research and Innovation in Building and Construction).

The goal is to make the IRC site an active, relevant and useful one-stop source of information. There are plans to add a searchable database of Frequently Asked Questions (FAQs) dealing with a variety of technical issues, as well as to increase linkages and information sharing with other national and international construction organizations.

Questions or suggestions about further ways to improve the site are welcomed. Contact Mike Culhane at (613) 993-3774, fax (613) 952-7671, or e-mail *mike.culhane@nrc-cnrc.gc.ca*.

SOLPLAN REVIEW is an independent Canadian Journal published 6 times per year to serve the needs of professionals and interested lay persons. It provides news, technical details, new product information, insights and commentary on developments covering all aspects of building science and energy efficient building practice for new and retrofit residential construction. Technical information is presented in a clear, concise manner, without resorting to jargon.

SOLPLAN REVIEW is an independent subscription supported publication, that relies on the support of readers. *If you are seeing this journal for the first time, and find it valuable, why not ensure you don't miss any copies. Subscribe today!*

YES, I WANT TO SUBSCRIBE TO **SOLPLAN REVIEW**

In Canada: 1 year: $50.29 ($47.00 + 3.29 GST) [NB, NS, NF $54.05 includes HST]
2 years: 90.95 ($85.00 + 5.95 GST) [NB, NS, NF $97.75 includes HST]
USA and other foreign: 1 year $54.00 per year 2 years: 98.00 (USA and other foreign in US funds)
Pay by: VISA MASTERCARD CHEQUE

Card No. _____ Exp. date: _____

Signature _____

NAME _____

ADDRESS _____

_____

POST CODE _____

the drawing-room graphics services ltd.
Box 86627 North Vancouver, B.C. V7L 4L2
FAX (604) 689-1841
e-mail: solplan@direct.ca